

people to confront the source of their trauma or anxiety by directing or changing the course of their dreams.

But the utility of strategies like these is limited by how well people can learn to lucid dream. Even with the best existing methods, results are spotty. Now, though, researchers have found a way to induce such dreams.

In 2014, Ursula Voss and her colleagues at Goethe University Frankfurt in Germany discovered that a technique known as transcranial alternating current stimulation could spur lucidity in dreams. It involves applying a low electrical current to the brain's frontal cortex during REM sleep, and it works about two-thirds of the time. "Stimulating the frontal area is like putting 'wake' activity into sleep," says Cloé Blanchette-Carrière at the Dream and Nightmare Laboratory in Montreal, Canada.

Blanchette-Carrière is interested in therapies that would trigger lucid dreams instead of relying on people teaching themselves to induce them. "We want to apply this to nightmare sufferers or PTSD patients, to make them able to modify or control their dreams," she says. She already has promising results from a preliminary study.

The next hurdle in using lucid dreams as a treatment is to communicate with someone once they are asleep, to provide external support as they face a source of trauma, for instance. Many of us have experienced incorporating a noise from the waking world into a dream – a horn honking outside, or music playing on a nearby radio, for instance. But can we deliberately send messages into people's dreams?

LUCID DREAMING FOR BEGINNERS

The simplest method to boost your chance of lucid dreaming is to perform "reality checks" during the day. As often as possible, stop to observe your environment and body, and ask yourself: "Is this a dream?" As this becomes a habit, it will be incorporated into your dreams. One night you will find yourself asking, "Is this a dream?" and realise, in fact, it is.

A more direct way is through the "Wake-Back-To-Bed" technique, which is exactly what it sounds like. Ideally, you should set an alarm about 2 hours before you normally wake up, which will put you at a phase in the sleep

cycle when REM sleep is longer and more intense. When the alarm goes off, sit up and stay awake for about 20 minutes. During this time it can help to think or write about the most recent dream you remember, noting anything that could have clued you in to the fact you were dreaming. When you go back to sleep, you should soon enter a dream, and your recently awake and intent mind is likely to follow.

Finally, you can complement these effortful techniques with technology. While there are many apps and sleep masks that are supposed to induce lucid dreams

To find out, Kristoffer Appel, a sleep and dream researcher at Osnabrück University in Germany, recruited experienced lucid dreamers and monitored their brain waves and eye movements as they slept. When in lucid dreams people are capable of moving their eyes deliberately, so Appel instructed his volunteers to let him know when they were lucid by looking left-right, left-right. Once he got the cue, he tried to send signals into their dreams using audio tones and flashing lights.

Hello in there

Of 10 volunteers, seven reported incorporating the sounds or lights into their dreams.

The tone might become a noise from a ship, car or cellphone. Some people registered the flashing lights as the whole dream turning bright and dark; for others, it was the lightning in a thunderstorm, or a lamp that switched on and off. Those who noticed the noises or lights realised that they were messages from the waking world.

But Appel wanted to go further: he wanted to send more complex messages, and he wanted the dreamers to respond. So he asked these same volunteers to learn basic Morse code for numbers. The idea was to use a series of audio tones to send the dreamers simple arithmetic problems, like $3 + 5$ or $7 - 2$.

The dreamers didn't know the numbers in advance, and were told to answer using Morse code eye signals. For instance, a "3" in Morse code is three short and two long dashes, so the subject would look three times to the left and two times to the right.

For Appel and the volunteers, it felt like



there was a lot at stake. Many people who can lucid dream have spent months, if not years, teaching themselves how. Although confident it would be possible to communicate from within their dreams, the volunteers feared they might let the side down by waking too soon or failing to find the signals. But it worked, at least for three of them: they not only got the signals, but gave the correct answers. One participant described how he looked around his dream for something that might convey signals from outside. He was in a bus terminal, and spotted a ticket machine. Soon, it began to beep. "I was thrilled to bits... I decoded the first message, confirmed the numbers, solved the math problem, and answered it back to the wak[ing] world: $4 + 4 = 8$. I next walked along the street further, telling other pedestrians that I was solving tasks within a lucid dream."

Relying on eye movements limits how much information can be conveyed, however. So Remington Mallett, a researcher then at the University of Missouri–St Louis, decided to try using a brain-computer interface, a device that – as the name suggests – enables the brain to talk directly to an external device such as a computer. Mallett believed lucid dreamers